MedCrave
Step into the World of Research

MOJ Public Health

Research Article

Open Access

CrossMark

Sleep deprivation, sleep stealers and risk behaviors in Portuguese adolescents - a cross-cultural comparison

Abstract

Objectives: To analyse the diverse mutual influences of sleep duration and sleep deprivation upon the sleep stealers and adolescent risk behaviours.

Methods: The survey is a component of the Health Behaviour in School-Aged Children study, on 3476 students attending the 8th grade and the 10th grade; the mean age was 14.9years. The questionnaire evaluated socio-demographics, sleep, sleep deprivation, sleep stealers and risk behaviours. Pearson correlations and chi-square tests were used to evaluate the behavioural differences between sleep deprived and non-sleep deprived students.

Results: Sleep deprivation was present in 18.9% of the adolescents. Several behaviours had higher prevalence in sleep deprived adolescents, namely: excessive use of mobile phone, of computer use during week days and of internet facilities; substance use (tobacco, alcohol and drugs); violence (namely fights and carrying weapons to school); sexual relations and sedentary behaviour. No differences were found for TV viewing.

Conclusion: Sleep stealers use and risk behaviors are increased by sleep deprivation; their correlations are complex in spite of similar association patterns. The prevalence of both sleep stealers and risk behaviours varies markedly across countries and therefore cultural differences, comparing youngsters of several continents and countries, are discussed.

Keywords: sleep deprivation, adolescence, mobile, multiscreen, alcohol, sexual relations, violence

Volume 3 Issue 1 - 2015

Teresa Paiva,[1,2] Tânia Gaspar,[2,3] Margarida Gaspar de Matos[2,4]

[1]Department of Medicine, CENC-Sleep Medicine Centre, Portugal
[2]Department of Medicine, University of Lisbon, Portugal
[3]Lusiada University, Portugal
[4]Department of Human Kinetics, University of Lisbon, Portugal

Correspondence: Teresa Paiva, Department of Medicine, CENC-Sleep Medicine Centre, Rua Conde das Antas, 5, Lisbon, Portugal, Tel +351968011648, Fax +351213715459, Email teresapaiva0@gmail.com

Received: April 10, 2015 | **Published:** December 03, 2015

Abbreviations: BMI, body mass index; EMC, electronic media communications; EU, Europe; FYROM, former Yugoslav republic of Macedonia; GABA, gamma-amino-butyric acid; HBSB, health behavior in school-aged children; NoSD, not sleep deprived; SD, sleep deprived; TV, television; UK, united kingdom; USA, united states of America; YRSBSS, youth risk behavior surveillance system

Introduction

Adolescents sleep shows marked variation in duration and variability;[1–3] this is caused by the specific maturation period of adolescence and by external factors, among which the increasing school demands, high tech gadgets, the need of social interactions and health related factors must be accounted for. Adolescents and young adults present important body and brain maturations, both leading to possible risk behaviours, often with dramatic individual and societal consequences. Due to specific maturation characteristics the adolescent brain remains more vulnerable to impulsive behaviours in sex, food and sleep habits. The predominance of glutamatergic neurotransmission over the inhibitory GABA neurotransmission is a possible explanation to impulsive behaviour and increases excitement;[4] furthermore they are more sensitive to reward then to punishment and they are likely to be influenced by immediate consequences neglecting long term disadvantages.[5,6] These features are certainly related to sleep behaviour patterns, whose disruption usually induces visible and manifest long term consequences, with subtle and less perceived short term effects. Finally, the persistent circadian misalignment in adolescents, simulating a chronic jetlag condition has been recently considered a problematic public health issue.[7] Furthermore, the importance of circadian misalignment in changing reward mechanisms has been considered as a potential explanation for the transition from alcohol abuse to alcoholic use disorder.[8]

Currently, among adolescent´s behaviors, two types have major impact upon sleep: those that reduce sleep duration (the Sleep stealers, mostly high tech media and gadgets) and those associated with health risks (the Health risk behaviors).[9] Nowadays the Sleep stealers are multiple and used simultaneously with multi screen viewing being a current practice as demonstrated in UK adolescents.[10] In the Health Behaviour in School-aged Children (HBSC) study on 15years old EU adolescent 62% of the girls and 64% of the boys watch television two or morehours on week days.[11] TV viewing is an overweight risk factor due to its association with reduced physical activity and increased caloric intake.[12–15] In effect TV viewing time and TV in the bedroom are associated with increased obesity and cardio-metabolic risk;[16–18] using regression analysis in a set of 962 pre-adolescent Dutch children, TV viewing was correlated with snaking in children with high levels of emotional eating[19] and with unhealthy food preferences in Danish,[20] Australian,[21] Portuguese,[22] Iranian[23] and European adolescents.[24] TV viewing is also an independent diabetes risk in obese and overweight adolescents[25] and in adolescence it seems to mediate adult TV viewing and adult obesity.[26] In an experimental study trying to identify the biomarkers of cardio-vascular risk, namely C-reactive

protein, complement factors C3 and C4, interleukin 6, adiponectin, leptin, E-selectin, L-selectin, plasminogen activator inhibitor 1 and intercellular adhesion molecule 1 in sedentary adolescents, only the last one, L-selectin and E-selectin were significantly correlated with TV viewing time.[27]

The recreational computer use is also associated with unhealthy food behaviors.[28] In a recent meta-analysis it was shown that sedentary behavior is associated with unhealthy dietary behaviors and with screen time and TV viewing.[29] Furthermore physiologic measures of isometric trunk muscle strength corroborate the negative association between screen time and physical capability.[30] The widely disseminated hypothesis that screen time is associated with increased Body Mass Index (BMI) has been recently questioned in Dutch adolescents,[31] since the increased energy intake associated with TV viewing could only be demonstrated in girls from 12-18years of age in the National Health and Nutrition Examination Survey from 2003-2006.[32] Low socio-economic status is associated with higher TV viewing.[33,34] Among Spanish school children (secondary level; n=256), socio-demographic and home environment had important influences in both TV viewing and screen time; boys had longer screen times than girls and for both, greater access to media in the room and longer parental TV viewing predicted children behavior.[35] A Norwegian study, in adolescents between 11 and 13years, was in line with these data founding as predictors of TV/screen time, more TV time spent by parents and less parental regulation.[36] An important issue is the demonstration that, in adolescents, the decrease in TV viewing predicts lower BMI at one year follow up;[37] such reduction is however not achieved by increased physical activity.[38]

According to the Youth Risk Behavior Surveillance System (YRBSS) the health risk behaviors among youths are: 1) behaviors that contribute to unintentional injuries and violence; 2) sexual behaviors contributing to sexually transmitted diseases and unintended pregnancy; 3) tobacco use; 4) alcohol and other drug use; 5) unhealthy dietary behaviors and 6) physical inactivity.[39] The youth risk behaviors have a high prevalence in the USA.[40] Risk behavior prevalence among adolescents varies across the world as shown in some of the following examples. In the EU and USA smoking prevalence is decreasing.[11,41] In Europe, data from the HBSC surveys undertaken between 2009-10, showed that 18% of the fifteen year old girls and 19% of the boys smoke at least once per week.[11] Once more, the influence of the media exposure as a modulator, especially for those at risk, was statistically significant.[42] In China, smoking was evaluated among 12708 adolescents of 21 schools in the region of Shanghai; the percentage of use was significantly reduced whenever pocket money was also reduced.[43]

In the HBSC study the data concerning alcohol consumption among the EU youngster are quite impressive, since 31% of the girls and 36% of the boys have been drunk at least twice in their lives.[11] The prevalence of alcohol consumption among Thai adolescents was 14.8% (21.2% males and 9.3% females); for boys the associated factors were being older, other substance use, sex, fights and injuries, while for girls´ poverty, smoking, physical fighting and lack of familiar integration were more relevant.[44] In the HBSC study 15% of the girls and 20% of the boys have ever used cannabis.[11] The data concerning adolescent sexual experiences in the USA show that 47.4% of the teens had already sexual intercourse and a reasonable percentage with violence (9.4%) or even forced sexual intercourse (8%).[45] A Dutch study demonstrated the relation with personality characteristics, at least in early sexual experiences: under controlling adolescents are early sexual developers who engage in more advanced, casual and risky sexual behavior than other adolescents; since these personality differences tended to disappear with advancing age[46] some authors postulate a neurobehavioral disinhibition as a substrate for sexual and other risk behaviors.[47] In African-Americans boys the exposure to traumatic life events was a risk factor for risky sexual behaviors.[48] In Brazil, data from 60,973adolescent participants in the National Survey of School Health, showed that about one quarter of the adolescents had had sexual intercourse, most of them before the age of 13; both school and family contexts were modulators of teens sexual behavior, with those less protected having the least protected behaviors;[49] the family protection has been also shown in USA studies.[50,51] Another Brazilian study in College students of 18years or older showed a high frequency of exposure to violence, as well as a high rate of Post -Traumatic Stress Disorder, suicide attempts and high-risk sexual behavior.[52] A UK study showed the impact of sexual TV media exposure and lack of parental restriction upon early sexual intercourse,[53] while other studies demonstrate the association of sexual risk behaviors with alcohol[54] and drug consumption.[55]

The impact of violence upon sleep duration was evaluated among African American adolescents; the prior existence of a sleep disturbance was associated with carrying or using a knife/gun, warmth toward the mother, worry and belief in the neighborhood street code; the observation of violent actions, using alcohol or having internalized anger were associated with latter occurrence of sleep disturbance.[56] Violent TV contents are likely to be associated with physical aggression behaviors.[57] Sedentary behaviors vary across countries. In Brazil where they are extremely prevalent (79.7% of the adolescents), significant positive associations were found with socioeconomic status, extensive TV viewing and negative associations with wellbeing.[58] Several studies point out the relations of sleep duration with screen time or TV viewing[33,59,60] and risk taking behaviors.[9,61,62] Violence exposure during playing games had significant impact upon sleep, both in heart rate variability and in reduced sleep quality.[63] The impact of prolonged violent video gaming upon sleep was also assessed by polysomnography: it significantly reduced sleep efficiency and total sleep time, while increasing subjective sleep latency.[64]

Furthermore sleep characteristics can influence behavior. Insomnia significantly predicted smoking, delinquency, drinking and risky driving,[65] while data from the YRSBSS from 2009, showed that students with insufficient sleep had higher odds for school violent behaviors and males were at increased risk of carrying a weapon to school.[66] In a Japanese study of 19,436 adolescents, bullying was significantly associated with irregular sleep-wake schedules and nocturnal cellular use phone.[67]

The association between eveningness and aggression or antisocial behavior was found, with E-types having more pronounced behavior disturbances and daytime impairments than morning types.[68] Therefore the aim of this study is to provide an in-depth analysis of the diverse influences of sleep duration and sleep deprivation upon other adolescents' features, namely those related to the sleep stealers and adolescent risk behaviours.

Materials and methods

The Portuguese survey reported in this study is a component of the Health Behaviour in School-Aged Children (HBSC) study.[11,57,69–71] This survey is based on a self-completed questionnaire to be administered in schools by teachers. The Portuguese HBSC survey included pupils in the 8th and 10th grades (high school); the mean age

was 14.91years (SD=1.255, min 12.5, max 19.0). The National sample consisted of 3476 students from 139 randomly chosen Portuguese schools, representing those school grades in the entire country, as geographically stratified by Education Regional Divisions. The school response rate was 89.9%. The gender and grade distribution were as follows: 53.8% (n=1869) were girls; in terms of school grade they were distributed as follows: 45.9% (n=1594) attending the 8th grade, 54.1% (n=1882) the 10th grade.

Procedure

The sample unit used in this survey was the class. In each school, classes were randomly selected in order to meet the required number of students for each grade, which was proportional to the number of students of the same grade for each specific region according to the numbers provided by the Portuguese Ministry of Education. Teachers administered the questionnaires in the classroom. Adolescents' participation in the survey was voluntary. Adolescents who were absent from school on the day of the survey were not included. The students' completion of the questionnaires was voluntary; anonymity was assured and the students completed it on their own. Teachers were only allowed to help with administrative procedures.

This study has the approval of a scientific committee, an ethical national committee and the national commission for data protection and followed strictly all the guidelines for protection of human rights. This study used a Health Behaviour in School-Aged Children (HBSC 2010) questionnaire and inquired about: 1) gender and age; 2) socio demographics and self-reported BMI; 3) Sleep duration during the week and weekends, sleep deprivation (SD) (defined as a difference in sleep duration equal/higher than 3hours between weekdays and weekends); 4) screen time (computer use: standard; games, internet; social networks, emails, e-media), 5) TV viewing and mobile phone use; 6) Sexual behaviour and overnight dating in friends; 7) Violent behaviours: fights; use of weapons; 8) Use of tobacco, alcohol and drugs; 9) Sedentary behaviour. The criteria used to evaluate high frequency of screen time were according to published data:[17,28] 3hours or more during the week and weekends.

Data analysis

Statistical analysis included descriptive analysis, analysis of variance and correlation/contingency analysis: Pearson correlation coefficients were used for continuous variables and Pearson chi-square for evaluation of frequency distributions. The comparison groups were SD (Sleep deprived adolescents) and NoSD (Adolescents without sleep deprivation). SPSS version 20 was used.

Results/Outcomes/Tangibles

The mean sleep duration is 7.52h, (min=5; max=10h) during the week and it is on average 1hour longer in the weekends (mean 8.78h); the mean difference between week and weekends is 1.25h+-1.59 (min=5, max=5h). Sleep duration in week days is curtailed in 38.5% and increased in 5.8% of the students, taking the normative values for age as reference;[72] sleep deprivation is further suspected by the substantial increase of those sleeping more than 10hours during weekends (42.6%), together with a significant persistence of those sleeping less than 7hours (21.1%). SD occurred in 18.9% of the students; in what concerns gender there were no significant differences between boys and girls (χ^2=.558; NS); it was however significantly more prevalent in the 10th grade (24.1%, while only 12.7% in the 8th grade; χ^2=67.323; p<.001); the same happened when age was compared: the average was 15.28years for SD and 14.82years for NoSD (F=67.154, p<.001). Furthermore a significant percentage of the adolescents has frequent difficulties in sleep initiation (25.5%) and clear sleep problems (37.2%). Adolescents with sleep deprivation have significantly more problems with sleep initiation (χ^2=50.463; p<.001).The students had a mean BMI of 20.93kg/m^2 (min=11.9; max=47.56). BMI is significantly negatively correlated with sleep duration during the week (r=-.092; p<.001) and during the weekend (r=-.063; p<.001) and positively correlated with SD (r=.050; p<.01); it was significantly higher in the SD group (21.24 versus 20.70 in the NoSD group; F=8.181; p<.01).

The so called sleep stealers among adolescents include: TV, computer, mobile phones, games and internet use. All of them are common among Portuguese school adolescents. Very few do not use them and many use them regularly (Table 1). TV viewing during the week and the weekends was a frequent habit (65.6% viewed TV 3h or more during week days; the percentage increased to 75.6% during weekends). The use frequency had no correlations with SD (χ^2=1.235; p=.539 and χ^2=.517; p=.770, respectively).

Using computer for 3 h or more per day was practised by 31.2% of the students during the week and increased to 53.6% during weekends. Computer usage during the weekends was also not associated with sleep deprivation (χ^2=3.581; p=.167), but the same was not true for use during weekdays significantly associated with SD (χ^2=8.568; p<.05). Some internet facilities were less used, namely blogs, online forums and online games and their use was not significantly influenced by SD; but email, search engines and social networks were used quite often (24.0; 52.7; 52.4 and 42.3%, respectively). Internet utilisation was however in several aspects significantly associated with SD, namely: email consultation (χ^2=19.202; p<.001); use of search engines (χ^2=17.694; p<.01); participation in social networks (χ^2=24.899; p<.001) and use of multimedia (χ^2=16.392; p<.01). However the participation in online games showed no association with SD (χ^2=3.536; p=.618). The students feelings and subjective consequences concerning internet use were impressively high: about a quarter of the students would feel depressed without internet, would prefer internet to friends, would have complaints concerning internet use, the sleep reduced and lower academic achievements and 52.8% would feel their life empty without internet. The impact of internet use upon students marks was also significantly correlated with SD (χ^2=11.591; p<.05); however, according to the students opinions, it did not influence sleep reduction (χ^2=4.625; p=.328) and did not influence other people complaints (χ^2=3.903; p=.419).

The use of mobile phones and e-media communications were also frequent (61.0 and 73.9%, respectively). Both were significantly higher in SD adolescents, with high significant levels (χ^2=26.609; p<.001; χ^2=19.202; p<.001, respectively). The prevalence of risk behaviours (Table 2) is relatively high in what concerns chronic use of alcoholic beverages (13.6%) and getting drunk (8.0%), use of soft drugs (11.4%) and hard drugs (7.3%). All these behaviours are more prevalent in the sleep deprived adolescents with high significance levels (χ^2=54.566; p<.001; χ^2=62.116; p<.001; χ^2=42.053; p<.001; χ^2=25.878; p<.001, respectively). The same occurred for smoking with a higher prevalence in the SD group (χ^2=29.936, p<.001). Sexual relations occurred in 21.3% of the students, with a significantly higher prevalence in SD. Aggressive behaviours such as carrying weapons to school (6.7%) or being involved in fights (19.6) are also relatively frequent and the prevalence increases in SD adolescents (χ^2=14.484; p<.01 and χ^2=14.331; p<.01, respectively). Sedentarism prevalence was 11.9% but had a significant relation with SD (χ^2=12.002, p<.05) (Table 2).

Citation: Paiva T, Gaspar T, Matos MG. Sleep deprivation, sleep stealers and risk behaviors in Portuguese adolescents - a cross-cultural comparison. *MOJ Public Health.* 2015;3(1):204–212. DOI: 10.15406/mojph.2015.03.00049

Table 1 The Sleep Stealers: The chi squares values, degrees of freedom and significance levels resulting from the Pearson chi square applied to compare the frequency distribution of each behavior or perception in sleep deprived and no sleep deprived adolescents

TV and high tech	**Chi2**	**Degrees of freedom**	**Significance level**
TV viewing weekdays	1.235	2	p= .539
TV viewing weekends	0.517	2	p= .772
Computer use weekdays	8.568	2	p< .05
Computer use weekends	3.581	2	p= .167
Computer games weekdays	1.299	2	p= .522
Computer games weekends	4,79	2	p= .098
Mobile Phones			
EMedia communications with friends	19,202	4	p< .001
How often you communicate with friends via the mobile	26.609	5	p< .001
Internet Use			
Using search engines	17,694	5	p< .01
Social networks	24.899	5	p< .001
Multimedia contents	16.392	5	p< .01
Online forums	4.418	5	p =.491
Online games	3.536	5	p =.618
Internet Use Consequences			
Others complain about your time in the net	3.903	4	p =.419
Your marks suffered from it	11.951	4	p< .05
Without it life would be … and empty	2.185	4	p =.702
Your sleep is reduced due to late on line hours	4.625	4	p =.328
Your prefer the net rather than being with your friends	3.187	4	p =.527
Are you depressed when "not in the net"	1.203	4	p =.878

Citation: Paiva T, Gaspar T, Matos MG. Sleep deprivation, sleep stealers and risk behaviors in Portuguese adolescents - a cross-cultural comparison. *MOJ Public Health.* 2015;3(1):204–212. DOI: 10.15406/mojph.2015.03.00049

Table 2 Risk behaviors-The chi squares values, degrees of freedom and significance levels resulting from the Pearson chi square applied to compare the frequency distribution of each behavior in sleep deprived and no sleep deprived adolescents

Alcohol	**Chi2**	**Degrees of Freedom**	**Significance Level**
Alcoholic beverages in the last 30 days	54.566	6	p<.001
Getting drunk	62,116	4	p<.001
Smoke			
Ever Smoke	29,936	1	p<.001
Drugs			
Drugs consumption in the last month	25.877	3	p<.001
Sex			
Sexual relations	24.582	1	p<.000
Violence			
How often in the last month did you carry a weapon to school	14.484	4	p<.01
How often in the last 12months were you involved in a fight	14	4	p<.01
Sedentary Behaviour			
Physical activity in the last 7days	12.002	4	p<.05

Conclusion

Our study obtained a detailed description of adolescents´ high tech use and risk behaviors during the 8th and 10th grades and correlated them with sleep deprivation. The main conclusions can be summarized as follows: 1) The average sleep duration is not low both during week and weekends, but there is marked variability and sleep curtailment was observed in 38.5% of the adolescents; 2) SD, defined as a difference equal/higher than 3hours between weekends and weekdays was present in 18.9% of the students. SD was negatively correlated with sleep duration in weekdays; 3) there were no gender differences but SD increased with age; 4) A considerable number of adolescents had sleep problems (37.2%) and 25.5% of them had difficulties in sleep initiation; this difficulty was significantly more prevalent in sleep deprived adolescents; 5) The average BMI was within the normal range, but 14.2% were overweight and 2.7% were obese; the BMI was negatively correlated with sleep duration during week days and weekends and positively correlated with SD; 6) In what concerns the sleep stealers we found no significant impact of TV viewing, while there were significant impacts of SD from computer and internet use, especially in what concerns email, search engines, social networks and multimedia usage, but no impact of on-line gambling; 7) Risk behaviours were relatively common, mostly in what concerned alcohol and drug consumption, hetero-aggressive behaviours, sexual behaviours and sedentarism. 8) All these behaviours were significantly more prevalent in sleep deprived adolescents.

The discussion of the results must however be started by methodological issues, implying both strengths and weaknesses. The strong points relate to the fact it was a national study, integrated in a multinational WHO research project. Data were well stratified, randomized and representative and the school response rate was very high. Due to the large number of addressed questions, those related to sleep were relatively simple: they implied the self-reported sleep duration during week and weekends and the difficulties in sleep initiation. In spite of that they allowed the evaluation of sleep deprivation, which was used as a dependent variable in Pearson correlations. Discussion of the obtained results is done in two steps: first the prevalence of the studied behaviours are compared with other studies, taking into account that methodological differences among studies do exist and second a comparison with the few studies evaluating these behaviours and sleep deprivation is presented.

The first and more natural comparison is with the HBSC study, since our data are integrated in it and have the same methodology,[11] except for what concerns sleep duration and sleep initiation problems; besides the HBSC study includes most European countries and also the USA and Canada. In the subsequent data we only refer to 15 year old adolescents since the average age of our study was 14.9years. In order to provide a cross cultural comparison countries were ranked; Table 3 summarizes a ranking of country´s prevalence for the basic sleep stealers and risk behaviours by selection of those in which prevalence was highest, namely the 7 worst cases and those for which the prevalence was lowest, the best 7 cases. At first sight it is clear that many countries are ranked at both extremes, having some bad and good scores. Only a few of them have exclusively good rankings (low prevalence) as it is the case for Iceland, FYROM, Germany, Finland, Russian Federation, Slovenia, Norway; some have predominantly high prevalence as is the case for Latvia, Lithuania, Greenland, Greece, Czech Republic. Most countries vary in both extremes, for instances, USA, Netherlands and Portugal have one high prevalence and three low prevalence values, among the 7 best scores; many countries have average values and do not score in both extremes.

Citation: Paiva T, Gaspar T, Matos MG. Sleep deprivation, sleep stealers and risk behaviors in Portuguese adolescents - a cross-cultural comparison. *MOJ Public Health.* 2015;3(1):204–212. DOI: 10.15406/mojph.2015.03.00049

In the HBSC study the average percentage of adolescent using Electronic Media Communications (EMC) everyday was 57% (65% for girls and 50% for boys) (Table 3). Canada and the USA had an average prevalence (67% for girls and 49% for boys in both countries). Portugal is among the great users with 77% of the girls and 62% of the boys. It must be recognised that even the low user countries have prevalence approaching the 50%[11] (Table 3). The use of EMC increases with age, is more frequent in girls, is usually associated with low activity levels and facilitates the danger of cyberbullying.[11] The frequent use of mobile phones is associated with poor sleep habits[73] and facilitates risk behaviours.[67,74,75]

Table 3 Country prevalence comparisons - HBSC study. The table shows the rankings of the prevalence comparisons of adolescent behaviors, selecting, for each behavior, the countries with the 7 higher (worse) and the 7 lowest (best) prevalence; it also shows the global average and gender proportion from the HBSC study

	EMC Everyday	**TV >2h**	**Smoking (>1x per week)**	**Alcohol (>2 times drunk)**	**Cannabis use (ever used)**	**Sexual (intercourse at/ before 15 years)**	**Fights (>3x in the last 12 months)**
Countries with the highest prevalence	Lithuania	Armenia	Greenland	Denmark	Canada	Greenland	Armenia
	Sweden	Slovakia	Lithuania	Lithuania	Czech R	Denmark	Greece
	Belgium	Lithuania	Austria	Wales	Switzerland	Wales	Ukraine
	Portugal	Greece	Latvia	Greenland	USA	Romania	Belgium
	England	Netherlands	Croatia	Latvia	Spain	Austria	Austria
	Scotland	Wales	Hungary	Estonia	France	Sweden	Hungary
	Italy	Ukraine	Czech R	Scotland/ Czech R	Latvia	Luxembourg	Slovakia
	Spain	Switzerland	Armenia	FYROM	FYROM	Slovakia	Germany
	Turkey	Iceland	Iceland	USA	Armenia	Poland	Greenland
	Slovakia	Slovenia	Canada	Italy	Norway	FYROM	Portugal
Countries with lowest prevalence	Germany	France	USA	Iceland	Greece	Lithuania	Denmark
	Hungary	Finland	Norway	Netherlands	Romania	Croatia	Estonia
	Netherlands	USA	Portugal	Luxembourg	Russia Fed.	Switzerland	Iceland
	Armenia	Belgium	FYROM	Portugal	Iceland	Netherlands	Finland/ Spain
HBSC Average	**65G/50B 57%**	**62G/64B 63%**	**17G/19B 18%**	**29G/34B 32%**	**15G/20B 17%**	**23G/29B 26%**	**5G/16G 10%**

EMC, electronic media communication; G, girls; B, boys

TV viewing for more than 2hours had an average prevalence of 63% (62 for girls and 64 for boys); in the countries with higher prevalence values it approached 80% of the adolescents (Armenia) while the lowest attendance was in Switzerland (38% for girls and 45% for boys).

It is clear that Portuguese adolescents use TV and screen time too many hours per day, being situated in a 17th place among HBSC countries and within the HBSC average value, at the age of 15.[11] However when compared with the USA data[41] TV for more than 3 h/day was more prevalent in Portugal (56.2 versus 33.3%), while the same range of computer use was quite similar in both countries (31.6 versus 31.1%, respectively). The ensemble of high tech gadgets available for juniors all over the world shows their impact upon sleep reduction. The joint consequences of high tech and sleep reduction have impact upon mental and somatic health in studies performed worldwide.[73,75–79] Our data do not show significant increase of SD with TV viewing and computer use, but demonstrate highly significant results for EMC (mobile phones), computer use on week days, use of search engines, participations in social networks and use of multimedia contents. In our view, these results and those of Bélanger et al.,[79] advice careful strategies in education and health campaigns. In the HBSC study[11] smoking at least once a week had an average prevalence of 18%; but in some countries, such has Greenland it

was practiced for more than 50% of the youngsters (Table 3). In Portugal the prevalence was below average, around 10%, but its use significantly higher in SD adolescents. In the USA-CDC report[41] smoking is more prevalent (44.7%). According to the HBSC report smoking campaigns and smoking bans are quite effective.[80]

Alcohol consumption increases with age and drunkenness episodes are becoming frequent among European youngsters;[11] having had 2 or more episodes has a prevalence of 32% (29 for girls and 34 for boys). Usually it occurs mostly in boys, but girl prevalence is increasing and it is already higher in 10 countries, among which those with higher drunkenness prevalence, namely Denmark, Wales, Greenland and Scotland (Table 3). In the USA drunkenness prevalence is very low, around 14%, in it is Portugal around 21% and in Canada around 34%. Cannabis use varies tremendously among countries. It is highest in Canada (33%) and lowest in FYROM (around 2.5%); the HBSC average is 17%, higher in boys. According to the CDC report it is 39.9%.[41] The perceived availability of Cannabis increases the rate of use and that might explain the countries with low prevalence use.[11] Prohibition oriented policies are usually inefficient,[81] demonstrating a different pattern of what is observed with tobacco.

In our study all the substance abuse behaviours were higher in SD adolescents. In line with our results a USA study in 704 adolescents proved the bidirectional associations between sleep and substance use, namely: cigarette use and weekend sleep were bi-directionally related, as were marijuana use and total sleep; alcohol use could predict shorter weekend oversleep while marijuana use predicted increased weekend sleep and weekend oversleep.[82]

Fights tend to decrease with age, for boys in all countries and for girls in most countries;[11] at the age of 15 they have a prevalence of 10%; the increased prevalence in boys is usually explained by the higher testosterone levels, delayed maturation of executive functions and involvement in other risk behaviours.[83] They also vary markedly among countries involving 54% of the boys in Armenia and only 7% in Germany. In Portugal fight involvement had also a low prevalence: it was experienced by 2% of the girls and 9% of the boys (Table 3). Unexpectedly, our data obtained in a country commonly referred as "quiet", show that carrying a weapon to school and being involved in fights had exactly the same percentages as those found in the USA by the CDC;[41] the correlation of fights and carrying a weapon and sleep deprivation was also observed in this study, with increased odds for boys.[66] The prevalence of sexual activity, namely having intercourse before 15years, also varied significantly across countries; the average prevalence was 26% (23 for girls and 29% for boys); the gender gap was not the same in all countries, since in 14 of them the prevalence was higher in girls. This was the case of Greenland, country with the highest prevalence 71% in girls and 46% in boys; in Slovakia, the country with the lowest prevalence, it was 10/15%, respectively; in Portugal it was 18/27% close to the average values. In our data early sexual relations were more prevalent in SD adolescents.

Whenever taking these data as an all it becomes clear that behaviours have complex relations with sleep deprivation, with multidirectional interactions, both between SD and risk behaviours and the sleep stealers use and among behaviours themselves. The approach needed for a more comprehensive understanding of the role of sleep in stabilizing and improving deleterious behaviours in youngsters worldwide requires robust measures and complex statistical models. The obtained data are relevant but preliminary and much work is still required since knowledge of the brain mechanisms involved in risk behaviours is lacking. Large scale education campaigns are required, but strategies must be adapted to the target behaviour. Support and involvement of several agents, from family to policy makers, are needed in order to improve worldwide health and global quality of life in adolescents.

Acknowledgements

To the HBSC group and to Aventura Social.

Conflict of interest

The author declares no conflict of interest.

References

1. Carskadon M. The second decade. In: Guilleminault C, editor. *Sleeping and waking disorders*. USA: Butterworth Publishers; 1982. p. 99–125.
2. Dahl R, Lewin D. Pathways to adolescent health: sleep regulation and behavior. *J Adolesc Health*. 2002;31:175–184.
3. Fredriksen K, Rhodes J, Reddy R, et al. Tracking the effects of adolescent sleep loss during the middle school years. *Child Dev*. 2004;75(1):84–95.
4. Arain M, Haque M, Johal L, et al. Maturation of the adolescent brain. *Neuropsychiatr Dis Treat*. 2013;9:449–461.
5. Bjork JM, Knutson B, Fong GW, et al. Incentive–elicited brain activation in adolescents: similarities and differences from young adults. *J Neurosci*. 2004;24(8):1793–1802.
6. Bjork JM, Smith AR, Danube CL, et al. Developmental differences in posterior mesofrontal cortex recruitment by risky rewards. *J Neurosci*. 2007;27(18):4839–4849.
7. Touitou Y. Adolescent sleep misalignment: a chronic jet lag and a matter of public health. *J Physiol Paris*. 2013;107(4):323–326.
8. Hasler BP, Clark DB. Circadian misalignment, reward–related brain function and adolescent alcohol involvement. *Alcohol Clin Exp Res*. 2013;37(4):558–565.
9. O'Brien E, Mindell J. Sleep and risk–taking behavior in adolescents. *Behav Sleep Med*. 2005;3:113–133.
10. Jago R, Sebire SJ, Gorely T, et al. "I'm on it 24/7 at the moment": a qualitative examination of multi–screen viewing behaviours among UK 10–11 year olds. *Int J Behav Nutr Phys Act*. 2011;8:85.
11. Currie C, Zanotti C, Morgan A, et al. *Social determinants of health and well–being among young people*. Health Behaviour in School–aged Children (HBSC) study: International Report From the 2009/2010 survey. Copenhagen: WHO Regional Office for Europe, 2012 (Health Policy for Children and Adolescents, No. 6); 2012.
12. Dennison BA, Erb TA, Jenkins PL. Television viewing and television in bedroom associated with overweight risk among low–income preschool children. *Pediatrics*. 2002;109(6):1028–1035.
13. Hancox RJ, Milne BJ, Poulton R. Association between child and adolescent television viewing and adult health: a longitudinal birth cohort study. *Lancet*. 2004;364(9430):257–262.
14. Wang N, Xu F, Zheng LQ, et al. Effects of television viewing on body fatness among Chinese children and adolescents. *Chin Med J (Engl)*. 2012;125(8):1500–1503.
15. Bickham DS, Blood EA, Walls CE, et al. Characteristics of screen media use associated with higher BMI in young adolescents. *Pediatrics*. 2013;131(5):935–941.
16. Sisson SB, Broyles ST. Social–ecological correlates of excessive TV viewing: difference by race and sex. *J Phys Act Health*. 2012;9(3):449–455.

17. Staiano AE, Harrington DM, Broyles ST, et al. Television, adiposity, and cardiometabolic risk in children and adolescents. *Am J Prev Med*. 2013;44(1):40–47.
18. Mota J, Santos R, Moreira C, et al. Cardio respiratory fitness and TV viewing in relation to metabolic risk factors in Portuguese adolescents. *Ann Hum Biol*. 2013;40(2):157–162.
19. Ouwens MA, Cebolla A, Van Strien T. Eating style, television viewing and snacking in pre–adolescent children. *Nutr Hosp*. 2012;27(4):1072–1078.
20. Hare–Bruun H, Nielsen BM, Kristensen PL, et al. Television viewing, food preferences, and food habits among children: a prospective epidemiological study. *BMC Public Health*. 2011;11:311.
21. Pearson N, Salmon J, Crawford D, et al. Are parental concerns for child TV viewing associated with child TV viewing and the home sedentary environment? *Int J Behav Nutr Phys Act*. 2011;8:102.
22. Ramos E, Costa A, Araújo J, et al. Effect of television viewing on food and nutrient intake among adolescents. *Nutrition*. 2013;29(11–12):1362–1367.
23. Ghavamzadeh S, Khalkhali HR, Alizadeh M. TV viewing, independent of physical activity and obesogenic foods, increases overweight and obesity in adolescents. *J Health Popul Nutr*. 2013;31(3):334–342.
24. Santaliestra–Pasías AM, Mouratidou T, Huybrechts I, et al. Increased sedentary behaviour is associated with unhealthy dietary patterns in European adolescents participating in the HELENA study. *Eur J Clin Nutr*. 2014;68:300–308.
25. Goldfield GS, Saunders TJ, Kenny GP, et al. Screen viewing and diabetes risk factors in overweight and obese adolescents. *Am J Prev Med*. 2013;44(4 Suppl 4):S364–S370.
26. Mamun AA, O'Callaghan MJ, Williams G, et al. Television watching from adolescence to adulthood and its association with BMI,waist circumference, waist to–hip ratio and obesity: a longitudinal study. *Public Health Nutr*. 2013;16(1):54–64.
27. MartínezGómez D, Veiga OL, Zapatera B, et al. Patterns of sedentary behavior and compliance with public health recommendations in Spanish adolescents:the AFINOS study. *Cad Saude Publica*. 2012;28(12):2237–2244.
28. Shi L, Mao Y. Excessive recreational computer use and food consumption behaviour among adolescents. *Ital J Pediatr*. 2010;36:52.
29. Pearson N, Biddle SJ. Sedentary behavior and dietary intake in children, adolescents, and adults. A systematic review. *Am J Prev Med*. 2011;41(2):178–188
30. Grøntved A, Ried–Larsen M, Froberg K, et al. Screen time viewing behaviors and isometric trunk muscle strength in youth. *Med Sci Sports Exerc*. 2013;45(10):1975–1980.
31. Altenburg TM, Singh AS, Van Mechelen W, et al. Direction of the association between body fatness and self–reported screen time in Dutch adolescents. *Int J Behav Nutr Phys Act*. 2012;9:4.
32. Sisson SB, Broyles ST, Robledo C, et al. Television viewing and variations in energy intake in adults and children in the USA. *Public Health Nutr*. 2012;15(4):609–617.
33. Padez C, Mourao I, Moreira P, et al. Long sleep duration and childhood overweight/obesity and body fat. *Am J Hum Biol*. 2009;21(3):371–376.
34. Coombs N, Shelton N, Rowlands A, et al. Children's and adolescents' sedentary behaviour in relation to socioeconomic position. *J Epidemiol Community Health*. 2013;67(10):868–874.
35. HoyosCillero I, Jago R. Systematic review of correlates of screen–viewing among young children. *Prev Med*. 2010;51(1):3–10.
36. Totland TH, Bjelland M, Lien N, et al. Adolescents' prospective screen time by gender and parental education, the mediation of parental influences. *Int J Behav Nutr Phys Act*. 2013;10:89.
37. French SA, Mitchell NR, Hannan PJ. Decrease in television viewing predicts lower body mass index at 1–year follow–up in adolescents, but not adults. *J Nutr Educ Behav*. 2012;44(5):415–422.
38. Rey–López JP, Bel–Serrat S, Santaliestra–Pasías A, et al. Sedentary behaviour and clustered metabolic risk in adolescents: the HELENA study. *Nutr Metab Cardiovasc Dis*. 2013;23(10):1017–1024.
39. Brener ND, Eaton DK, Kann LK, et al. Behaviors related to physical activity and nutrition among U.S. high school students. *J Adolesc Health*. 2013;53(4):539–546.
40. Eaton DK, Kann L, Kinchen S, et al. Centers for Disease Control and Prevention (CDC). Youth risk behavior surveillance – United States, 2011. *MMWR Surveill Summ*. 2012;61(4):1–162.
41. CDC. Cigarette Use Among High School Students – United States, 1991–2009. *MMWR*. 2010;59(26):797–801.
42. Tanski SE, Stoolmiller M, Gerrard M, et al. Moderation of the association between media exposure and youth smoking onset: race/ethnicity, and parent smoking. *Prev Sci*. 2012;13(1):55–63.
43. Ma J, Zhu J, Li N, et al. Cigarette smoking in Chinese adolescents: importance of controlling the amount of pocket money. *Public Health*. 2013;127(7):687–693.
44. Pengpid S, Peltzer K. Alcohol use and associated factors among adolescent students in Thailand. *West Indian Med J*. 2012;61(9):890–896.
45. Center of Disease Control. 2013.
46. Baams L, Overbeek G, SemonDubas J, et al. On Early Starters and Late Bloomers: The Development of Sexual Behavior in Adolescence Across Personality Types. *J Sex Res*. 2014;51(7):754–764
47. Riggs NR, Tate EB, Ridenour TA, et al. Longitudinal associations from neurobehavioral disinhibition to adolescent risky sexual behavior in boys: direct and mediated effects through moderate alcohol consumption. *J Adolesc Health*. 2013;53(4):465–470.
48. Murry VM, Simons RL, Simons LG, et al. Contributions of family environment and parenting processes to sexual risk and substance use of rural African American males: a 4–year longitudinal analysis. *Am J Orthopsychiatry*. 2013;83(2 Pt 3):299–309.
49. Oliveira–Campos M, Giatti L, Malta D, et al. Contextual factors associated with sexual behavior among Brazilian adolescents. *Ann Epidemiol*. 2013;23(10):629–635.
50. Caruthers AS, Van Ryzin MJ, Dishion TJ. Preventing High–Risk Sexual Behavior in Early Adulthood with Family Interventions in Adolescence: Outcomes and Developmental Processes. *Prev Sci*. 2014;1:S59–S69.
51. Lyerly JE, Brunner Huber LR. The role of family conflict on risky sexual behavior in adolescents aged 15 to 21. *Ann Epidemiol*. 2013;23(4):233–235.
52. Netto LR, Cavalcanti–Ribeiro P, Pereira JL, et al. Clinical and socio–demographic characteristics of college students exposed to traumatic experiences: a census of seven college institutions in northeastern Brazil. *PloS One*. 2013;8(11):e78677.
53. Parkes A, Wight D, Hunt K, et al. Are sexual media exposure, parental restrictions on media use and co–viewing TV and DVDs with parents and friends associated with teenagers' early sexual behaviour? *J Adolesc*. 2013;36(6):1121–1133.
54. Muchimba M, Haberstick BC, Corley RP, et al. Frequency of alcohol use in adolescence as a marker for subsequent sexual risk behavior in adulthood. *J Adolesc Health*. 2013;53(2):215–221.

Citation: Paiva T, Gaspar T, Matos MG. Sleep deprivation, sleep stealers and risk behaviors in Portuguese adolescents - a cross-cultural comparison. *MOJ Public Health.* 2015;3(1):204–212. DOI: 10.15406/mojph.2015.03.00049

55. Schuster RM, Mermelstein R, Wakschlag L. Gender–specific relationships between depressive symptoms, marijuana use,parental communication and risky sexual behavior in adolescence. *J Youth Adolesc*. 2013;42(8):1194–1209.

56. Umlauf MG, Bolland JM, Lian BE. Sleep disturbance and risk behaviors among inner–city African–American adolescents. *J Urban Health*. 2011;8(6):1130–1142.

57. Matos AP, Ferreira JA, Haase RF. Television and aggression: a test of a mediated model with a sample of Portuguese students. *J Soc Psychol*. 2012;152(1):75–91.

58. Dumith SC, Hallal PC, Menezes AM, et al. Sedentary behavior in adolescents: the 11–year follow–up of the 1993 Pelotas (Brazil) birth cohort study. *Cad Saude Publica*. 2010;26(10):1928–1936.

59. Arora T, Hussain S, Hubert Lam KB, et al. Exploring the complex pathways among specific types of technology, self–reported sleep duration and body mass index in UK adolescents. *Int J Obes (Lond)*. 2013;37(9):1254–1260.

60. Al–Hazzaa HM, Musaiger AO, Abahussain NA, et al. Lifestyle correlates of self–reported sleep duration among Saudi adolescents: a multicenter school–based cross–sectional study. *Child Care Health Dev*. 2014;40(4):533–542.

61. Yen CF, King BH, Tang TC. The association between short and long nocturnal sleep durations and risky behaviours and the moderating factors in Taiwanese adolescents. *Psychiatry Res*. 2010;179(1):69–74.

62. Popovici I, French MT. Binge drinking and sleep problems among young adults. *Drug Alcohol Depend*. 2013;132(1–2):207–215.

63. Ivarsson M, Anderson M, Åkerstedt T, et al. The effect of violent and nonviolent video games on heart rate variability, sleep, and emotions in adolescents with different violent gaming habits. *Psychosom Med*. 2013;75(4):390–396.

64. King DL, Gradisar M, Drummond A, et al. The impact of prolonged violent video–gaming on adolescent sleep: an experimental study. *J Sleep Res*. 2013;22(2):137–143.

65. Catrett CD, Gaultney JF. Possible insomnia predicts some risky behaviors among adolescents when controlling for depressive symptoms. *J Genet Psychol*. 2009;170(4):287–309.

66. Hildenbrand AK, Daly BP, Nicholls E, et al. Increased risk for school violence–related behaviors among adolescents with insufficient sleep. *J Sch Health*. 2013;83(6):408–814.

67. Tochigi M, Nishida A, Shimodera S, et al. Irregular bedtime and nocturnal cellular phone usage as risk factors for being involved in bullying: a cross–sectional survey of Japanese adolescents. *PLoS One*. 2012;7(9):e45736.

68. Schlarb AA, Sopp R, Ambiel D, et al. Chronotype–related differences in childhood and adolescent aggression and antisocial behavior – A review of the literature. *Chronobiol Int*. 2014;31(1):1–16.

69. Currie C, Hurrelmann K, Settertobulte W, et al. *Health and health behavior among young people*. Health Behaviour in School–aged Children: a WHO cross–national study (HBSC). Portugal: World Health Organization; 2000.

70. Currie C, Roberts C, Morgan A, et al. *HBSC, and WHO cross national study: research protocol for the 2001/2002 survey*. Copenhagen: WHO; 2004.

71. Matos MG, Simões C, Tomé G, Gaspar T, Camacho I, et al. *Portuguese adolescents' health today and in eight years: HBSC*. Portugal: FMH & CMDT; 2006.

72. Carskadon M. *Adolescent Sleep Patterns: Biological, Social and Psychological Influences*. USA: Cambridge University Press; 2002.

73. Punamäki RL, Wallenius M, Nygård CH, et al. Use of information and communication technology (ICT) and perceived health in adolescence: the role of sleeping habits and waking–time tiredness. *J Adolesc*. 2007;30(4):569–585.

74. Leena K, Tomi L, Arja RR. Intensity of mobile phone use and health compromising behaviours—how is information and communication technology connected to health–related lifestyle in adolescence? *J Adolesc*. 2005;28(1):35–47.

75. Council on Communications and Media, Strasburger VC. Children, adolescents, obesity, and the media. *Pediatrics*. 2011;128(1):201–208.

76. Hardoff D. Health issues in adolescents' Internet use – benefits and risks. *Georgian Med News*. 2013;(222):99–103.

77. Choi K, Son H, Park M, et al. Internet overuse and excessive daytime sleepiness in adolescents. *Psychiatry Clin Neurosci*. 2009;63(4):455–462.

78. Do YK, Shin E, Bautista MA, et al. The associations between self–reported sleep duration and adolescent health outcomes: what is the role of time spent on Internet use? *Sleep Med*. 2013;14(2):195–200.

79. Bélanger RE, Akre C, Berchtold A, et al. A U–shaped association between intensity of Internet use and adolescent health. *Pediatrics*. 2011;127(2):e330–e335.

80. Hublet A, Schmid H, Clays E, et al. HBSC Research Network. Association between tobacco control policies and smoking behaviour among adolescents in 29 European countries. *Addiction*. 2009;104(11):1918–1926.

81. Simons–Morton B, Pickett W, Boyce W, et al. Cross–national comparison of adolescent drinking and cannabis use in the United States, Canada, and the Netherlands. *Int J Drug Policy*. 2010;21(1):64–69.

82. Pasch KE, Latimer LA, Cance JD, et al. Longitudinal bi–directional relationships between sleep and youth substance use. *J Youth Adolesc*. 2012;41(9):1184–1196.

83. Romer D, Betancourt LM, Brodsky NL, et al. Does adolescent risk taking imply weak executive function? A prospective study of relations between working memory performance, impulsivity, and risk taking in early adolescence. *Dev Sci*. 2011;14(5):1119–1133.

Citation: Paiva T, Gaspar T, Matos MG. Sleep deprivation, sleep stealers and risk behaviors in Portuguese adolescents - a cross-cultural comparison. *MOJ Public Health.* 2015;3(1):204–212. DOI: 10.15406/mojph.2015.03.00049